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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/561,883

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Adrian Boyle

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EXAMINER

SCARLETT, SHAKA S

ART UNIT

PAPER NUMBER

2823

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/561,883	<b>Applicant(s)</b> BOYLE ET AL.	
	<b>Examiner</b> SHAKA SCARLETT	<b>Art Unit</b> 2823	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 23 December 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 25-40 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 25-40 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 December 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☒ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>12/23/2005</u> .  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Specification***

1. The following guidelines illustrate the preferred layout for the specification of a utility application. These guidelines are suggested for the applicant's use.

#### **Arrangement of the Specification**

As provided in 37 CFR 1.77(b), the specification of a utility application should include the following sections in order. Each of the lettered items should appear in upper case, without underlining or bold type, as a section heading. If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

- (a) TITLE OF THE INVENTION.
- (b) CROSS-REFERENCE TO RELATED APPLICATIONS.
- (c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.
- (d) THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT.
- (e) INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC.
- (f) BACKGROUND OF THE INVENTION.
  - (1) Field of the Invention.
  - (2) Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98.
- (g) BRIEF SUMMARY OF THE INVENTION.
- (h) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S).
- (i) DETAILED DESCRIPTION OF THE INVENTION.
- (j) CLAIM OR CLAIMS (commencing on a separate sheet).
- (k) ABSTRACT OF THE DISCLOSURE (commencing on a separate sheet).
- (l) SEQUENCE LISTING (See MPEP § 2424 and 37 CFR 1.821-1.825. A "Sequence Listing" is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required "Sequence Listing" is not submitted as an electronic document on compact disc).

### ***Drawings***

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "picking and

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placing ... to the die pad” and the apparatus claimed in claim 40 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Claim Objections***

3. Claims 25, 26, 38, 40, and 48 are objected to because of the following informalities: It is unclear whether the first adhesive layer and the adhesive layer are one and the same. If the adhesive layer is the first adhesive layer, then for consistency, the adhesive layer must be referred to as the first adhesive layer for consistency.

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Further the limitation “more than at most...” is confusing. It is unclear what applicant is trying to claim.

Appropriate correction is required.

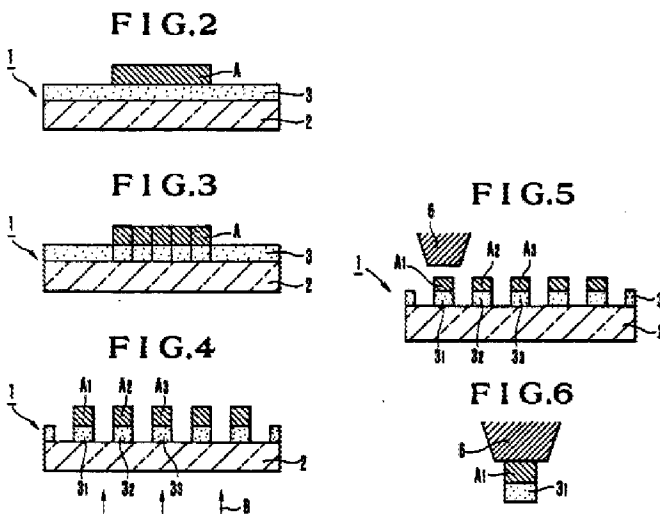
4. Claim 28 is objected to because of the following informalities: it is unclear to which curing step is referred to from claim 25. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

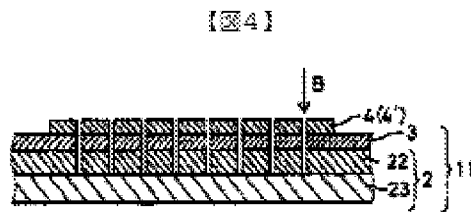
5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 25 - 30, 33, 37, 39, 40, 41 – 44, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Komiyama et al. (US 5,110,388) in view of Izumi et al. (JP 2002343747 A).



**Regarding Claim 25**, Komiyama et al. discloses a method of die bonding comprising the steps of: a. providing a structure comprising a wafer substrate (A) separated from carrier base means (2) by an adhesive layer adhered to the carrier base means by a first adhesive (3) between the carrier base (2) and the adhesive layer (3) (Column 5, line 55 – 59; Column 6, line 4 – 5); b. machining through the wafer substrate (2) and the first adhesive (3) to form a singulated die with an attached singulated adhesive layer (Column 6, line 6 - 9); c. curing the structure to release the attached singulated adhesive layer (3) from the carrier base (2) means by curing the first adhesive (Column 6, line 24 – 27, 44 – 45); d. picking and placing the die and attached singulated adhesive layer on a die pad (Column 6, line 49 – 53; Column 7, line 6 – 7); and e. curing the attached singulated adhesive layer to adhere the die to the die pad (Column 7, line 6 – 21), but fails to disclose laser machining and machining no more than at most to scribe the carrier base.



However, Izumi et al. discloses a method comprising a wafer (4) separated by a carrier base (2) by means of an adhesive layer (3) wherein a laser machining is performed on the wafer (4), adhesive layer (3), and partially through the carrier base (2) in order to form a singulated die (Paragraph 0027, line 2 – 4; Paragraph 0028, line 1 – 3).

Therefore it would have been obvious to one of ordinary skill in the art at the time of applicant's invention to modify the invention of Komiyama et al. with using a laser beam and scribing the carrier base as taught by Izumi et al. as it would provide the motivation to separate a wafer into a plurality of dies without chipping the wafer which occurs during dicing with a saw blade, and it would provide the motivation to cut through the wafer, adhesive, and partially through the carrier base to ensure that adhesive layer is cut through completely.

**Regarding Claim 26**, Komiyama et al. and Izumi et al. in combination disclose a method as claimed in claim 25, wherein the step of laser machining comprises laser machining the wafer substrate using a first laser beam with a first machining profile of selected laser pulse power, laser pulse repetition rate, laser pulse width, laser beam scanning speed and laser wavelength; using a second laser beam with a second such machining profile to machine the adhesive layer and using a third laser beam with a third such machining profile to machine the carrier base means such that a speed of machining is maximised while providing a predetermined quality of singulated dies without substantial delamination of the adhesive layer and the carrier base means or substantial production of burrs (Izumi et al., Paragraph 0027, line 2 – 4; Paragraph 0028, line 1 – 3; Paragraph 0036, line 1 – 8).

**Regarding Claim 27**, Komiyama et al. and Izumi et al. in combination disclose a method as claimed in claim 26, wherein at least two of the first machining profile, the second machining profile and the third machining profile are a same machining profile

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(Izumi et al., Paragraph 0027, line 2 – 4; Paragraph 0028, line 1 – 3; Paragraph 0036, line 1 – 8).

**Regarding Claim 28**, Komiyama et al. and Izumi et al. in combination disclose a method as claimed in claim 25, wherein the step of curing the structure comprises curing with ultraviolet light (Komiyama et al., Column 6, line 24 - 30).

**Regarding Claim 29**, Komiyama et al. and Izumi et al. in combination disclose a method as claimed in claim 25, wherein the step of curing the attached singulated adhesive layer comprises heat curing the adhesive layer (Komiyama et al., Column 7, line 6 – 15).

**Regarding Claim 30**, Komiyama et al. and Izumi et al. in combination disclose a method as claimed in claim 25, wherein the step of machining the wafer substrate comprises machining a blind via in the wafer substrate or a via through the wafer substrate and the adhesive layer (Izumi et al, Fig. 4, Paragraph 0027, line 2 – 4).

**Regarding Claim 33**, Komiyama et al. and Izumi et al. in combination disclose a method as claimed in claim 25, wherein the step of providing a structure comprises providing a structure having a wafer substrate less than 800 microns thick (Izumi et al., Paragraph 0036, line 1 – 2).

**Regarding Claim 37**, Komiyama et al. and Izumi et al. in combination disclose a method as claimed in claim 25, wherein the carrier base means is one of: a dicing tape, an inflexible tape suitable for thin wafer dicing or backgrinding; and a glass or other transparent solid (Komiyama et al., Paragraph 0032, line 21 – 24).



**Regarding Claim 39**, Komiyama et al. and Izumi et al. in combination disclose a method as claimed in claim 25, wherein the step of picking and placing the die and attached singulated adhesive layer comprises picking and placing the die and attached singulated adhesive layer on another die to form a multistack die package (Komiyama et al., Column 6, line 49 – 53; Column 7, line 6 – 7, 18 – 21).

**Regarding Claim 40**, Komiyama et al. discloses a die bonding apparatus comprising: machining means arranged for machining a wafer substrate and an adhesive layer adhered to the wafer substrate and attached to carrier base means by a first adhesive between the carrier base means and the adhesive layer and for no more than at most scribing underlying carrier base means to form a singulated die with a singulated adhesive layer (Column 6, line 6 - 9); first curing means arranged for curing the first adhesive to release the singulated adhesive layer from the carrier base means (Column 6, line 24 – 27, 44 – 45); pick and place means arranged for picking the singulated die and adhesive layer from the carrier base means and placing the singulated die and adhesive layer on die pad means (Column 6, line 49 – 53; Column 7, line 6 – 7) and second curing means arranged for curing the singulated adhesive layer of the singulated die to adhere the singulated die to the die pad means (Column 7, line 6 – 21), but fails to disclose a laser machining means (See rejection against claim 25).

However, Izumi et al. discloses a method comprising a wafer (4) separated by a carrier base (2) by means of an adhesive layer (3) wherein a laser machining means is performed on the wafer (4), adhesive layer (3), and partially through the carrier base (2)

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in order to form a singulated die (Paragraph 0027, line 2 – 4; Paragraph 0028, line 1 – 3).

Therefore it would have been obvious to one of ordinary skill in the art at the time of applicant's invention to modify the invention of Komiyama et al. with using a laser beam and scribing the carrier base as taught by Izumi et al. as it would provide the motivation to separate a wafer into a plurality of dies without chipping the wafer which occurs during dicing with a saw blade, and it would provide the motivation to cut through the wafer, adhesive, and partially through the carrier base to ensure that adhesive layer is cut through completely.

**Regarding Claim 41**, Komiyama et al. and Izumi et al. in combination disclose a die bonding apparatus as claimed in claim 40, wherein the laser machining means comprises: laser source means arranged for providing a pulsed laser beam; laser beam scanning means; and control means arranged for controlling at least one of laser pulse energy, laser wavelength, laser repetition frequency, laser pulse width, laser beam scanning speed and a number of scans by the pulsed laser beam (Izumi et al. Paragraph 0036, line 5 - 8).

**Regarding Claim 42**, Komiyama et al. and Izumi et al. in combination disclose a die bonding apparatus as claimed in claim 41, wherein the laser machining means further comprises memory means for storing a machining profile of at least one of laser pulse energy, laser wavelength, laser repetition frequency, laser pulse width, laser beam scanning speed and a number of scans by the pulsed laser beam, for use by the control means (Izumi et al. Paragraph 0036, line 5 - 8).

**Regarding Claim 43**, Komiyama et al. and Izumi et al. in combination disclose a die bonding apparatus as claimed in claim 40, wherein the first curing means comprising with ultraviolet curing means (Komiyama et al., Column 6, line 24 - 30).

**Regarding Claim 44**, Komiyama et al. and Izumi et al. in combination disclose a die bonding apparatus as claimed in claim 40, wherein the second curing means comprises heat curing means (Komiyama et al., Column 7, line 6 – 15).

**Regarding Claim 47**, Komiyama et al. and Izumi et al. in combination disclose a die bonding apparatus as claimed in claim 40, adapted for carrier base means which is one of: a dicing tape, an inflexible tape suitable for thin wafer dicing or backgrinding; and a glass or other transparent solid (Komiyama et al., Paragraph 0032, line 21 – 24).

7. Claims 31, 32, 45, and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Komiyama et al. (US 5,110,388) in view of Izumi et al. (JP 2002343747 A) as applied above and further in view of Mignardi et al. (US 5,597,767).

**Regarding Claim 31**, Komiyama et al. and Izumi et al. in combination fails to disclose a method as claimed in claim 25, wherein the step of laser machining includes a further step, after laser machining, of washing the structure to remove accumulated laser machining debris from the singulated die.

However, Mignardi et al. discloses a method of separating wafer wherein after laser scribing, the wafer is washed to remove particles during lasing (Column 4, line 8 – 11).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the invention of Komiyama et al. and Izumi et al. in combination with washing the die after lasing to remove debris as taught by Mignardi et al. as it would provide the motivation to remove unwanted debris formed during laser processes.

**Regarding Claim 32**, Komiyama et al., Izumi et al., and Mignardi et al. in combination a method as claimed in claim 31, wherein the step of providing a structure comprises providing a structure having a protective film to protect the structure from debris produced during laser machining (Mignardi et al., Column 3, line 32 – 35) and the step of washing the structure comprises removing the protective film and accumulated debris thereon (Mignardi et al., Column 4, line 8 – 11).

**Regarding Claim 45**, Komiyama et al. and Izumi et al. in combination fail to disclose a die bonding apparatus as claimed in claim 40, including washing means arranged for washing laser machining debris from the singulated die.

However, Mignardi et al. discloses a method of separating wafer wherein after laser scribing, the wafer is washed to remove particles during lasing (Column 4, line 8 – 11).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the invention of Komiyama et al. and Izumi et al. in combination with washing the die after lasing to remove debris as taught by Mignardi et

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al. as it would provide the motivation to remove unwanted debris formed during laser processes.

**Regarding Claim 46**, Komiyama et al., Izumi et al., and Mignardi et al. in combination discloses a die bonding apparatus as claimed in claim 45, wherein the wafer substrate is provided with a protective film (Mignardi et al., Column 3, line 32 – 35) to protect the wafer substrate from laser machining debris, and the washing means (Mignardi et al., Column 4, line 8 – 11) is arranged to remove the protective film from the singulated die.

8. Claims 34 – 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Komiyama et al. (US 5,110,388) in view of Izumi et al. (JP 2002343747 A) as applied above and further in view of Morris et al. (US 6,472,295 B1).

**Regarding Claim 34**, Komiyama et al. and Izumi et al. in combination fail to disclose a method as claimed in claim 25, wherein the step of laser machining comprises providing an assist gas environment for laser machining.

However, Morris et al. discloses a method of laser cutting wherein a gas is provided during laser cutting (Column 10, line 1 – 5).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the invention of Komiyama et al. and Izumi et al. in combination with providing a gas during laser cutting as taught by Morris et al. as it would provide the motivation to actively remove debris and to cool the surface.

**Regarding Claim 35**, Komiyama et al., Izumi et al., and Morris et al. in combination disclose a method as claimed in claim 34, wherein the step of providing an assist gas environment comprises providing a gas environment in which photo-dissociation produces active radicals (Morris et al., Column 10, 1 – 5).

**Regarding Claim 36**, Komiyama et al., Izumi et al., and Morris et al. in combination disclose a method as claimed in claim 34, wherein the step of providing a gas environment reduces deposition of solid machining debris around a laser-machining site (Morris et al., Column 10, 1 – 5).

9. Claims 38 and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Komiyama et al. (US 5,110,388) in view of Morris et al. (US 6,472,295 B1) as applied above and further in view of Yamanaka (US 5,641,714).

**Regarding Claim 38**, Komiyama et al., Izumi et al., and Morris et al. in combination fail to disclose a method as claimed in claim 25, wherein the step of providing a structure comprises providing a structure including a wafer substrate separated facedown from substantially inflexible transparent backgrinding tape means by the adhesive layer and the step of laser machining is performed subsequent to backgrinding the wafer substrate.

However, Yamanaka discloses a method of singulating a wafer into dies wherein a wafer is affixed to a tape and back-grinded to thin the wafer before dicing the wafer (Column 4, line 21 – 23; Fig. 2A).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the invention of Komiyama et al., Izumi et al., and Morris et al. with performing a back-grinding step on the wafer prior to dicing as taught by Yamanaka as it would provide the motivation to form a substantially thin wafer prior to dicing to reduce the wafer to a desired thickness.

**Regarding Claim 48**, Komiyama et al., Izumi et al., and Morris et al. in combination fail to disclose a die bonding apparatus as claimed in claim 40, adapted for machining a structure comprising a wafer substrate separated facedown from substantially inflexible transparent backgrinding tape means by the adhesive layer.

However, Yamanaka discloses a method of singulating a wafer into dies wherein a wafer is affixed to a tape and back-grinded to thin the wafer before dicing the wafer (Column 4, line 21 – 23; Fig. 2A).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the invention of Komiyama et al., Izumi et al., and Morris et al. with performing a back-grinding step on the wafer prior to dicing as taught by Yamanaka as it would provide the motivation to form a substantially thin wafer prior to dicing to reduce the wafer to a desired thickness.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHAKA SCARLETT whose telephone number is (571)270-3089. The examiner can normally be reached on Monday-Friday 7:30 AM - 5:00 PM EST.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

August 28, 2009  
/Shaka Scarlett/  
Examiner, Art Unit 2823

/W. David Coleman/  
Primary Examiner, Art Unit 2823